



# **Enhancing Sustainability Performance in Aquatic Centers: A Lifecycle Approach**

Progress Update 2 (Year 1 | Jun-Dec 2024)

#### **Prepared for**

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City of Richmond	Myrtha Pools
City of Burnaby	HCMA Architecture + Design
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Dec 18, 2024





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## 1. Progress Update

The overview of the research progress and status of key objectives and themes as of Dec 2024 is shown in Table 1 below.

Theme	Tasks	Outcomes	Progress	Personnel	
Theme A	<b>Task A-1</b> : Measurement of parameters and DBPs in water and air	• Selection of performance indicators A comprehensive literature review on DBPs in indoor settings and their relationship with key precursors is completed. The parameters mentioned are detailed in previous sampling plan documents.	Completed	Ghulam Hussain <i>(PhD1)</i>	
		• Sampling of COK1 facility Two sampling campaigns have been conducted in COK1 for all targeted parameters, completing the two targeted seasons. Results are obtained, and the analysis is ongoing.	Ongoing		
	<b>Task A-2:</b> Development of predictive models	• Literature Review and Data Collection Literature review on the deployment of 3D CFD models, air/water interface modeling, and validation with real-time data, data collection from partner facilities in conjunction w/ A-1 and B-1.	Pending	PhD2 (on- boarding)	
Theme B	<b>Task B-1</b> : Building energy and air quality performance assessment	<ul> <li>Literature Review</li> <li>A comprehensive literature review is in its final stages, considering the energy performance data of aquatic centers in Canada and internationally.</li> <li>Data Collection and Energy Simulations</li> <li>A detailed questionnaire for collecting operational data from the partner facilities has been completed. Collected data will be utilized for energy simulations.</li> </ul>	Ongoing	Lakkitha ( <i>MASc2</i> )	
	<b>Task B-2</b> : Occupant Surveys	• Ethics Approval Ethics application for occupant surveys is in progress; a detailed questionnaire has been prepared. The ethics approval application is finalized and will be submitted in a few weeks. The survey will be initiated as soon as the approval is received.	Ongoing	Haniya <i>(MASc1)</i>	



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Theme C	Task C-1: Human health risk, environmental, and economic assessments	<ul> <li>Literature Review         A comprehensive literature review of techniques for integrating health risk, environmental assessment and economic principles is underway.         Data Collection and Cost-Benefit Analysis         A questionnaire to collect operational data of partner facilities for cost-benefit analysis is finalized. Data collection will be started in the coming weeks.     </li> </ul>	Ongoing	Haniya ( <i>MASc1</i> ) PhD2 ( <i>on-boarding</i> ) PhD3 ( <i>TBD</i> )
	Task C-2: Dynamic simulation testbed of the facility energy system	• Literature Review and Data Planning A comprehensive literature review of relevant simulation models and planning of required data and monitoring equipment is underway.	Ongoing	Lakkitha ( <i>MASc2</i> )
	<b>Task C-3:</b> Development of optimal operational strategies and dashboard	• Literature Review and Data Planning Comprehensive literature review of relevant operational strategies and dashboard development and deployment.	Pending	PhD3 ( <i>TBD</i> )



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#### 2. Project Timeline and Deliverables

This research has been divided into three themes as follows.

Theme 1: Monitoring pool air and water status

Theme 2: Assessment of building energy and indoor environment

Theme 3: Development of optimal operational strategies and ePool dashboard

The tasks to be performed under each phase, their timelines, and expected deliverables are given in Table 2

### **Table 2.** Project Timeline and Deliverables

		2023		2024		2025				2026				2027	
Themes and Tasks	PIs and HQP	May-July Aug-Oct No	lov-Jan	Feb-April May-July	y Aug-Oct N	lov-Jan	Feb-April	May-July	Aug-Oct	Nov-Jan	Feb-April	May-July	Aug-Oct	Nov-Jan	Feb-April
<b>Theme A: Monitoring Pool Water Statu</b>	S														
Task A-1: Measurement of water and air quality	Sadiq, PhD1, MASc1	Managerial Work	k*	D1			D4			D7					
Task A-2: Development of predictive models integrating CFD & fugacity	Sadiq, PhD2, RA				D3						D8				
Theme B: Assessment of Building Energy	gy and Indoor Enviro	onment					J.					l	1		
Task B-1: Building energy and air quality performance assessment	Hewage, PhD3	Managerial Work	k*		D2				D6						
Task B-2: Formulation of operational scenarios for controlling DBPs and others	Sadiq, Hewage, PhD2, PhD3, RA										D9				
Theme C: Development of Optimal Ope	erational Strategies a	nd ePool Dashboard			<u>I</u> I			1		1				1	1
Task C-1: Human health risk and life cycle assessment for defined scenarios	Sadiq, MacNeill, PhD2, PhD3, MASc1						D5				D10	D11			
Task C-2: Identification of optimal operational strategies	Sadiq, Hewage, MacNeill, PhD3, RA														
Task C-3: Development of optimal operational strategies and dashboard	Sadiq, PhD3, RA												D12		D13

\*Project approved in March 2023, formally initiated in January 2024 after students were on board and administrative requirements were completed. HQP: Highly Qualified Personnel, PhD1: Ghulam Hussain, MASc1: Haniya Marium Anwar



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# 3. Future Work

A short-term research work plan for the next few months is given in Table 3.

Theme	Tasks	Future Work	Personnel
Theme A	<b>Task A-1:</b> Measurement of parameters and DBPs in water and air	<ul> <li>Sampling visits to COB1 and COR1 under winter conditions</li> <li>Deliverable D1: Report on DBP status of COK1, COB1, and COR1.</li> <li>Development of predictive DBP models based on collected data</li> </ul>	<ul> <li>Ghulam Hussain (<i>PhD1</i>)</li> </ul>
Theme BTask B-1: Building energy and air quality performance assessment		<ul> <li>Data collection through questionnaires and subsequent assessment of the energy performance of facilities</li> <li>Energy simulations of aquatic facilities based on collected data, including building layouts</li> <li>Deliverable D2: Preliminary report on the building energy performance of ISPs</li> </ul>	<ul> <li>Lakkitha (MASc2)</li> </ul>
	Task B-2: Occupant surveys	<ul> <li>Completion of ethics approval for questionnaire and deployment alongside sampling visits to COK1, COB1, and COR1</li> </ul>	<ul> <li>Haniya Marium Anwar (<i>MASc1</i>)</li> </ul>
Theme C	<b>Task C-1:</b> Human health risk, environmental, and economic assessments	<ul> <li>Data collection through questionnaire and subsequent cost-benefit analysis of aquatic facilities.</li> </ul>	<ul> <li>Haniya Marium Anwar (<i>MASc1</i>)</li> </ul>

## **Table 3.** Future Work (Short-Term)